

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Sakurai et al	Art Unit: 2626
Serial No.: 10/714,174	Confirmation No.: 2911
Filed: November 14, 2003	Examiner: Leonard Saint Cyr
	Docket: TI-35272

For: PHASE LOCKING METHOD FOR FREQUENCY DOMAIN TIME SCALE
MODIFICATION BASED ON A BARK-SCALE SPECTRAL PARTITION

Appeal Brief under 37 C.F.R. §41.37

Board of Patent Appeals and Interferences
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is Appellant's Appeal Brief filed pursuant to
37 C.F.R. §41.37 and the Notice of Appeal filed January 5, 2009.

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Real Party in Interest

The real party in interest in this application is Texas Instruments Incorporated, a corporation of Delaware with its principle place of business in Dallas, Texas. An assignment to Texas Instruments Incorporated is recorded at reel 015137 and frames 0810 to 0812.

Related Appeals and Interferences

There are no appeals of interferences related to this appeal in this application.

Status of the Claims

Claims 1 to 10 are rejected and subject to this appeal. No claims are allowed.

Status of Amendments Filed After Final Rejection

No amendments to the claims were proposed following the FINAL REJECTION of October 1, 2008.

Summary of Claimed Subject Matter

The subject matter of independent claims 1 and 6 and separately argued claims 2 to 5 and 7 to 10 of this application is taught in the application as follows:

Claim 1	Application
1. (Previously Presented) A method of converting an input digital audio signal into an output digital audio signal having a modified time scale comprising the steps of:	500 , page 10, line 7 to page 11, line 10; 600 , page 12, line 9 to page 13, line 7.

calculating a discrete Fourier transform of first equally spaced, overlapping time windows having a first overlap amount of the input digital audio signal;	page 2, lines 11 to 14; page 8, lines 2 to 6; page 9, lines 3 to 5; 501 , page 10, lines 9 to 12; 601 , page 12, lines 11 to 12.
partitioning the spectrum into a plurality of contiguous spectral bands according to a Bark scale where each spectral band has an extent dependent upon human frequency perception;	page 4, lines 1 and 2; 502 , page 10, lines 12 to 17 including Table 1; page 11, lines 11 to 16; 602 , page 12, lines 12 to 14.
identifying a dominant spectral line having the greatest magnitude within each spectral band;	page 4, line 2; 403 , page 9, lines 7 to 9; 503 , page 10, lines 19 and 20, 603 , page 12, lines 14 and 14.
calculating a phase difference for the dominant spectral line of each spectral band by a phase vocoder algorithm;	302 , page 8, line 6 to 16; 404 , page 9, lines 8 to 11; 505 , page 10, lines 21 to 23; 606 , page 12, lines 27 to 29.
calculating a phase difference for each of a predetermined number of spectral lines near the dominant spectral line within each spectral band as the phase difference of the corresponding dominant spectral line;	page 4, lines 4 and 5; page 11, lines 18 to 19; 506 , page 10, line 23 to page 11, line 3; 607 , page 12, line 29 to page 13, line 1.
calculating a phase difference for other spectral lines of each spectral band by the phase vocoder algorithm; and	page 4, lines 7 to 10; 507 , page 11, lines 5 to 8; page 11, lines 28 to 30; 608 , page 13, lines 1 to 4.

calculating an inverse discrete Fourier transform resulting in equally spaced, overlapping time windows having a second overlap amount employing the calculated phase difference for each spectral line thereby producing the output digital audio signal, the second overlap selected having a ratio to the first overlap amount to achieve a desired time scale modification.	303 , page 8, lines 17 to 19; 406 , page 9, line 30 to page 10, line 2; 508 , page 11, lines 7 to 10; 609 , page 13, lines 4 to 7.
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Claim 2	Application
2. The method of claim 1, wherein:	500 , page 10, line 7 to page 11, line 10; 600 , page 12, line 9 to page 13, line 7.
the predetermined number of spectral lines near the dominant spectral line is 4 for a 1024-point spectrum.	page 4, line 6.

Claim 3	Application
3. The method of claim 1, further comprising the step of:	500 , page 10, line 7 to page 11, line 10; 600 , page 12, line 9 to page 13, line 7.
merging nearby spectral lines that are within a predetermined frequency range of each other prior to calculating the phase difference.	504 , page 10, lines 20 and 21; 605 , page 12, lines 26 and 27.

Claim 4	Application
4. The method of claim 1, wherein:	500 , page 10, line 7 to page 11, line 10; 600 , page 12, line 9 to page 13, line 7.

said step of partitioning the spectrum into a plurality of contiguous spectral bands according to a Bark scale employs predetermined spectral bands unrelated to the digital audio signal.	page 11, lines 14 to 16; 502 , page 10, lines 12 to 17 including Table 1; 602 , page 12, lines 12 to 14.
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Claim 5	Application
5. The method of claim 1, wherein:	500 , page 10, line 7 to page 11, line 10; 600 , page 12, line 9 to page 13, line 7.
said step of partitioning the spectrum into a plurality of contiguous spectral bands according to a Bark scale includes adjusting boundaries of spectral bands to maintain important frequency groups within the same spectral band.	604 , page 12, lines 15 to 24.

Claim 6	Application
6. A digital audio apparatus comprising:	100 , page 5, lines 5 to page 6, line 25.
a source of a digital audio signal;	103 ; page 5, lines 11 to 18.
a digital signal processor connected to said source of a digital audio signal programmed to perform time scale modification on the digital audio signal by	123 , page 5, lines 25 to 29
calculate a discrete Fourier transform of first equally spaced, overlapping time windows having a first overlap amount,	page 2, lines 11 to 14; page 8, lines 2 to 6; page 9, lines 3 to 5; 501 , page 10, lines 9 to 12; 601 , page 12, lines 11 to 12.

partition the spectrum into a plurality of contiguous spectral bands according to a Bark scale where each spectral band has an extent dependent upon human frequency perception,	page 4, lines 1 and 2; 502 , page 10, lines 12 to 17 including Table 1; page 11, lines 11 to 16; 602 , page 12, lines 12 to 14.
identify a dominant spectral line having the greatest magnitude within each spectral band,	page 4, line 2; 403 , page 9, lines 7 to 9; 503 , page 10, lines 19 and 20; 603 , page 12, lines 14 and 14.
calculate a phase difference for the dominant spectral line of each spectral band by a phase vocoder algorithm,	302 , page 8, line 6 to 16; 404 , page 9, lines 8 to 11; 505 , page 10, lines 21 to 23; 606 , page 12, lines 27 to 29.
calculate a phase difference for each of a predetermined number of spectral lines near the dominant spectral line within each spectral band as the phase difference of the corresponding dominant spectral line;	page 4, lines 4 and 5; page 11, lines 18 to 19; 506 , page 10, line 23 to page 11, line 3; 607 , page 12, line 29 to page 13, line 1.
calculate a phase difference for other spectral lines of each spectral band by the phase vocoder algorithm, and	page 4, lines 7 to 10; 507 , page 11, lines 5 to 8; page 11, lines 28 to 30; 608 , page 13, lines 1 to 4.

<p>calculate an inverse discrete Fourier transform using equally spaced, overlapping time windows having a second overlap amount employing the calculated phase difference for each spectral line thereby forming a time scale modified digital audio signal, the second overlap selected having a ratio to the first overlap amount to achieve a desired time scale modification; and</p>	<p>303, page 8, lines 17 to 19; 406, page 9, line 30 to page 10, line 2; 508, page 11, lines 7 to 10; 609, page 13, lines 4 to 7.</p>
<p>an output device connected to the digital signal processor for outputting the time scale modified digital audio signal.</p>	<p>130, page 6, lines 21 to 24.</p>

Claim 7	Application
<p>7. The digital audio apparatus of claim 6, wherein:</p>	<p>100, page 5, lines 5 to page 6, line 25.</p>
<p>the predetermined number of spectral lines near the dominant spectral line is 4 for a 1024-point spectrum.</p>	<p>page 4, line 6.</p>

Claim 8	Application
<p>8. The digital audio apparatus of claim 6, wherein:</p>	<p>100, page 5, lines 5 to page 6, line 25.</p>
<p>said digital audio apparatus is further programmed to merge nearby spectral lines that are within a predetermined frequency range of each other prior to calculating the phase difference.</p>	<p>504, page 10, lines 20 and 21; 605, page 12, lines 26 and 27.</p>

Claim 9	Application
9. The digital audio apparatus of claim 6, wherein:	100 , page 5, lines 5 to page 6, line 25.
said digital audio apparatus is further programmed to partition the spectrum into a plurality of contiguous spectral bands according to a Bark scale unrelated to the digital audio signal.	page 11, lines 14 to 16; 502 , page 10, lines 12 to 17 including Table 1; 602 , page 12, lines 12 to 14.

Claim 10	Application
10. The digital audio apparatus of claim 1, wherein:	100 , page 5, lines 5 to page 6, line 25.
said digital audio apparatus is further programmed to partition the spectrum into a plurality of contiguous spectral bands according to a Bark scale includes adjusting boundaries of spectral bands to maintain important frequency groups within the same spectral band.	604, page 12, lines 15 to 24.

No claims include means plus function or step plus function limitations.

Grounds for Rejection to be Reviewed on Appeal

Claims 1 to 10 were rejected under 35 U.S.C. 103(a) as made obvious by the combination of Dolson U.S. Patent No. 6,112,169 and Laroche U.S. Patent No. 6,766,300.

Arguments

Claims 1 to 10 were rejected under 35 U.S.C. 103(a) as made obvious by the combination of Dolson U.S. Patent No. 6,112,169 and Laroche U.S. Patent No. 6,766,300.

Claims 1 and 6 recite subject matter not made obvious by the combination of Dolson and Laroche. Claims 1 and 6 recite partitioning "the spectrum into a plurality of contiguous spectral bands according to a Bark scale where each spectral band has an extent dependent upon human frequency perception." The FINAL REJECTION states at page 6, lines 8 to 11:

"However, Dolson does not specifically teach partitioning the spectrum into a plurality of contiguous spectral bands according to a Bark scale.

"Laroche teaches that a better sub-band decomposition could be used using frequency bands uniform in a bark scale (col. 3, lines 55 - 58)."

The Applicants submit this combination of references is improper because the teachings of Dolson and Laroche are incompatible. Dolson states at column 5, lines 18 to 25:

"At step 206, signal processing system 100 divides each magnitude spectrum into contiguous frequency regions. Each contiguous frequency region includes a single significant peak. The borders between contiguous frequency regions may be selected in a number of ways. In one embodiment, the channel midway between two significant peaks becomes the border between the corresponding contiguous frequency regions."

The Applicant's submit that the only way to ensure that "Each contiguous frequency region includes a single significant peak" as required by Dolson is to select the frequency bands to make that happen. This is taught in Dolson. The selection of frequency bands to ensure one significant peak in each band

cannot ensure that the frequency bands are "according to a Bark scale where each spectral band has an extent dependent upon human frequency perception" as recited in claims 1 and 6 and taught in Laroche. One skilled in the art would not be motivated to combine the Bark scale frequency bands of Laroche with the "single significant peak" per band taught in Dolson because these two conditions cannot be assured. The provision of a "signal significant peak" of Dolson depends upon the received data. The Bark scale frequency bands of Laroche do not depend upon the input data but only upon human hearing perception. Because Dolson teaches other processes dependent upon providing only a "single significant peak" per band, a technique such as Bark scale frequency bands cannot be used with the teachings of Dolson. Accordingly, because the teachings of Dolson and Laroche are incompatible, their combination cannot make obvious claims 1 and 6.

The ADVISORY ACTION states at the continuation of paragraph 11, lines 1 to 5:

"The combination of Dolson in Laroche teaches partitioning the spectrum into a plurality of contiguous spectral bands according a Bark scale, since Dolson discloses 'partitioning at least one DFT representative of the sequence into a set of contiguous frequency regions' (col. 3, lines 25 - 29); and Laroche discloses 'a better sub-band decomposition could be using bands uniform in a bark scale' (col. 3, lines 55 - 58)."

The Applicants agree that Dolson and Laroche separately disclose these limitations of claims 1 and 6. However, this statement by the Examiner fails to address the Applicants' argument previously stated in the response filed June 9, 2008, page 6, line 6 to page 7, line 6 and in the response filed December 1, 2008 at page 6, line 6 to page 7, line 16. The teaching of Dolson and Laroche cannot be combined because they are incompatible. The prior

responses and the above argument quote portions of Dolson and Laroche that support this assertion. The Applicants assert that these arguments overcome the Examiner's rejection. In order to sustain this rejection the Examiner must refute this argument. The Examiner merely repeated the original rejection rather than attempt to refute or even mention this argument. The Applicants respectfully submit this rejection cannot be sustained without overcoming the Applicants' arguments.

Claims 1 and 6 recite further subject matter not made obvious by the combination of Dolson and Laroche. Claims 1 and 6 recite calculating "a phase difference for each of a predetermined number of spectral lines near the dominant spectral line within each spectral band as the phase difference of the corresponding dominant spectral line." The FINAL REJECTION cites Dolson at column 5, lines 50 to 60 which states:

"At step 212, signal processing system 100 computes the remaining phase values in each contiguous frequency regions. These are determined so as to preserve the original relationship between phase values, despite the change in the phase value of the significant peak. In one embodiment, the phase values are simply shifted by adding or subtracting the same number that was added to or subtracted from the phase value for the significant peak. This preserves the linear differences among the phases. FIG. 6 shows the phase values additively shifted to match the change in phase value for the perceptually significant peak."

While the recitation of Dolson "phase values are shifted by subtracting the same number that was subtracted from the phase value for the significant peak" could make obvious the recited "the phase difference of the corresponding dominant spectral line," Dolson applies this teaching to a different portion of the spectra. Dolson discloses applying this "same number" teaching to "the remaining phase values in each contiguous frequency regions." The Applicants submit this limitation does

not make obvious the limitation "spectral lines near the dominant spectral line within each spectral band" as recited in claims 1 and 6. The FINAL REJECTION includes no argument that this teaching of Dolson refers to the same part of the spectra as the recitations of claims 1 and 6. The FINAL REJECTION includes no argument that the combination of Dolson and Laroche makes obvious this limitation. Accordingly, claims 1 and 6 are allowable over the combination of Dolson and Laroche.

Claims 1 and 6 recite further subject matter not made obvious by the combination of Dolson and Laroche. Claims 1 and 6 further recite calculating a phase difference "for other spectral lines of each spectral band by the phase vocoder algorithm." The cited portion of Dolson includes no teaching of a phase vocoder algorithm. The FINAL REJECTION points to no such language in either Dolson or Laroche. In the absence of any indication of the applicability of the references to this language of claims 1 and 6, the rejection must fail. Accordingly, claims 1 and 6 are allowable over claims 1 and 6.

Claims 1 and 6 recite yet further subject matter not made obvious by the combination of Dolson and Laroche. Claims 1 and 6 require different phase difference calculation for the "predetermined number of spectral lines near the dominant spectral line" and for the "other spectral lines." The FINAL REJECTION cites column 5, lines 50 to 60 as making obvious both this and the prior limitation. The teaching of Dolson may make obvious one of these two techniques. However, the FINAL REJECTION includes no indication how a single teaching of Dolson can make obvious different phase difference calculations for different spectral peaks in the spectral band as recited in claims 1 and 6. Note that claims 1 and 6 require differing calculations by recitation of different language applied to differing portions of the frequency band by recitation of different language. In order for the same portion of Dolson to

make obvious both these recitations, the Examiner must put forth some argument regarding both sets of limitations. The Examiner has not made such an argument and the Applicants believe there is no such argument. Accordingly, claims 1 and 6 are allowable over the combination of Dolson and Laroche.

Claims 2 and 7 recite further subject matter not made obvious by the combination of Dolson and Laroche. Claims 2 and 7 recite "the predetermined number of spectral lines near the dominant spectral line is 4 for a 1024-point spectrum." The FINAL REJECTION cites no portions of either reference as making obvious this limitation. The FINAL REJECTION states at page 6, line 16 to page 7, line 3:

"As per claims 2, and 7, Dotson in view of Laroche do not specifically teach that the predetermined number of spectral lines near the dominant spectral line is 4 for a 1024-point spectrum. However, since Dolson teaches adjusting phases of other channels within a particular contiguous frequency region containing the particular significant peak (col. 3, lines 32 - 34). One having ordinary skill in the art at the time the invention was made to consider a predetermined number of spectral lines near the dominant spectral line in Dolson in view of Laroche, so that original phase relationships across channels within the particular contiguous frequency region can be preserved (col. 3, lines 34 - 36)."

Adjusting phases of other channels as taught in Dolson fails to make obvious that there are a predetermined number of such lines. This teaching of Dolson likewise fails to make obvious that this predetermined number is 4. Accordingly, the combination of Dolson and Laroche cannot make obvious the particular predetermined number 4 recited in claims 2 and 7. The above quoted statements of the FINAL REJECTION are at most an indication of OFFICIAL NOTICE or within the knowledge of someone in the Patent Office of the fact that "the predetermined number

of spectral lines near the dominant spectral line is 4 for a 1024-point spectrum." The Applicants respectfully traverse this OFFICIAL NOTICE and request citation of relevant art according to 37 CFR 1.104(c)(2). In the absence of citation of art to make obvious this limitation of claims 2 and 7, these claims are not made obvious by the combination of Dolson and Laroche.

Claims 3 and 8 recite subject matter not made obvious by the combination of Dolson and Laroche. Claims 3 and 8 recite merging "nearby spectral lines that are within a predetermined frequency range of each other prior to calculating the phase difference." The FINAL REJECTION cites Dolson at column 3, lines 8 to 12 as making obvious this limitation, citing the disclosed "sequence of overlapping windows." Dolson states at column 3, lines 8 to 12:

"For example, the present invention applies to analysis-synthesis systems based on a sequence of overlapping windowed, DFT representations in which either: (1) the analysis transforms overlap in time by a different amount than the synthesis transforms, or (2) the modification involves a re-mapping of transform values from one frequency location to another."

The Applicants submit this teaching of Dolson includes no mention of the claimed spectral lines or any equivalent, or of the claimed merging or any equivalent. The "sequence of overlapping windows" taught in this portion of Dolson refer to overlap in time as indicated by Dolson at column 4, line 67 to column 5, line 6, which states:

"FIG. 2 assumes that a sound signal has been converted to a sequence of samples that are available in electronic memory, e.g., RAM 104. At step 202, signal processing system 100 divides the sound signal into a series of overlapping data frames and applies a windowed DFT to each overlapping data frame."

This clearly shows that the taught overlap is in data frames of a time sampled sound signal. The Applicants respectfully submit that data frames overlapping in time cannot make obvious the merging of spectral lines recited in claims 3 and 8. Accordingly, claims 3 and 8 are not made obvious by the combination of Dolson and Laroche.

Claims 4 and 9 recite subject matter not made obvious by the combination of Dolson and Laroche. Claims 4 and 9 recite partitioning "the spectrum into a plurality of contiguous spectral bands according to a Bark scale employs predetermined spectral bands unrelated to the digital audio signal." The FINAL REJECTION cites Figures 4 to 6 and column 5, lines 42 to 49 of Dolson as making obvious this subject matter. Dolson states at column 5, lines 42 to 49:

"FIG. 4 shows the phase values for a 10 channel wide contiguous frequency region of a particular DFT representation prior to step 208. A value 402 corresponds to the significant peak of this region. FIG. 5 shows the phase values for the same region after step 210. Value 402 has changed to a new value 502 according to the Portnoff formula whereas the phases of the other channels remain unchanged."

The Applicants respectfully submit that this portion of Dolson includes no teaching of the selection of the borders of frequency bands. This portion of Dolson teaches phase values assigned to such frequency bands without any indication how the frequency band boundaries are determined. In addition, Dolson states at column 5, lines 17 to 24:

"At step 206, signal processing system 100 divides each magnitude spectrum into contiguous frequency regions. Each contiguous frequency region includes a single significant peak. The borders between contiguous frequency regions may be selected in a number of ways. In one embodiment, the channel midway between two significant peaks becomes the

border between the corresponding contiguous frequency regions."

This disclosure of Dolson states that the borders between frequency regions can be selected in numerous ways. However, this portion of Dolson fails to teach that the borders of the frequency regions are predetermined and not dependent upon the digital audio signal. This portion of Dolson states that each region includes "a single significant peak." This disclosure is inconsistent with the claimed predetermined bands. The claimed predetermined bands may result in one, plural or no significant peaks within each band. The Applicants respectfully submit the only way to always have exactly one significant peak in each region is to select the regions to make this happen. This portion of Dolson states that one manner of dividing the frequency regions makes the border midway between two significant peaks. Such a partitioning is clearly dependent upon the digital audio data contrary to the recitations of claims 4 and 9. The general language of Dolson ("The borders between contiguous frequency regions may be selected in a number of ways.") does not exclude the recited predetermined spectral bands. However, the general limitation ("Each contiguous frequency region includes a single significant peak.") and the only example of Dolson ("In one embodiment, the channel midway between two significant peaks becomes the border between the corresponding contiguous frequency regions.") are contrary to an express limitation of claims 4 and 9 ("predetermined spectral bands unrelated to the digital audio signal."). The Applicants respectfully submit that the limitations of claims 4 and 9 would thus not be obvious to one skilled in the art from this disclosure of Dolson. Accordingly, claims 4 and 9 are allowable over the combination of Dolson and Laroche.

Claims 5 and 10 recite subject matter not made obvious by the combination of Dolson and Laroche. Claims 5 and 10 recite partitioning "the spectrum into a plurality of contiguous spectral bands according to a Bark scale by adjusting boundaries of spectral bands to maintain important frequency groups within the same spectral band." The FINAL REJECTION cites column 5, lines 20 to 24 of Dolson as making obvious this subject matter. This portion of Dolson discloses making the channel border between frequency regions midway between significant peaks. Dolson thus teaches separating these significant peaks. This does not make obvious the opposite limitation of maintaining "important frequency groups within the same spectral band" recited in claims 5 and 10. Accordingly, claims 5 and 10 are allowable over the combination of Dolson and Laroche.

If the Examiner has any questions or other correspondence regarding this application, Applicants request that the Examiner contact Applicants' attorney at the below listed telephone number and address to facilitate prosecution.

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CLAIMS APPENDIX

1 1. A method of converting an input digital audio signal
2 into an output digital audio signal having a modified time scale
3 comprising the steps of:

4 calculating a discrete Fourier transform of first equally
5 spaced, overlapping time windows having a first overlap amount of
6 the input digital audio signal;

7 partitioning the spectrum into a plurality of contiguous
8 spectral bands according to a Bark scale where each spectral band
9 has an extent dependent upon human frequency perception;

10 identifying a dominant spectral line having the greatest
11 magnitude within each spectral band;

12 calculating a phase difference for the dominant spectral
13 line of each spectral band by a phase vocoder algorithm;

14 calculating a phase difference for each of a predetermined
15 number of spectral lines near the dominant spectral line within
16 each spectral band as the phase difference of the corresponding
17 dominant spectral line;

18 calculating a phase difference for other spectral lines of
19 each spectral band by the phase vocoder algorithm; and

20 calculating an inverse discrete Fourier transform resulting
21 in equally spaced, overlapping time windows having a second
22 overlap amount employing the calculated phase difference for each
23 spectral line thereby producing the output digital audio signal,
24 the second overlap selected having a ratio to the first overlap
25 amount to achieve a desired time scale modification.

1 2. The method of claim 1, wherein:

2 the predetermined number of spectral lines near the dominant
3 spectral line is 4 for a 1024-point spectrum.

1 3. The method of claim 1, further comprising the step of:

2 merging nearby spectral lines that are within a
3 predetermined frequency range of each other prior to calculating
4 the phase difference.

1 4. The method of claim 1, wherein:
2 said step of partitioning the spectrum into a plurality of
3 contiguous spectral bands according to a Bark scale employs
4 predetermined spectral bands unrelated to the digital audio
5 signal.

1 5. The method of claim 1, wherein:
2 said step of partitioning the spectrum into a plurality of
3 contiguous spectral bands according to a Bark scale includes
4 adjusting boundaries of spectral bands to maintain important
5 frequency groups within the same spectral band.

1 6. A digital audio apparatus comprising:
2 a source of a digital audio signal;
3 a digital signal processor connected to said source of a
4 digital audio signal programmed to perform time scale
5 modification on the digital audio signal by
6 calculate a discrete Fourier transform of first equally
7 spaced, overlapping time windows having a first overlap
8 amount,
9 partition the spectrum into a plurality of contiguous
10 spectral bands according to a Bark scale where each spectral
11 band has an extent dependent upon human frequency
12 perception,
13 identify a dominant spectral line having the greatest
14 magnitude within each spectral band,
15 calculate a phase difference for the dominant spectral
16 line of each spectral band by a phase vocoder algorithm,
17 calculate a phase difference for each of a

18 predetermined number of spectral lines near the dominant
19 spectral line within each spectral band as the phase
20 difference of the corresponding dominant spectral line;
21 calculate a phase difference for other spectral lines
22 of each spectral band by the phase vocoder algorithm, and
23 calculate an inverse discrete Fourier transform using
24 equally spaced, overlapping time windows having a second
25 overlap amount employing the calculated phase difference for
26 each spectral line thereby forming a time scale modified
27 digital audio signal, the second overlap selected having a
28 ratio to the first overlap amount to achieve a desired time
29 scale modification; and
30 an output device connected to the digital signal processor
31 for outputting the time scale modified digital audio signal.

1 7. The digital audio apparatus of claim 6, wherein:
2 the predetermined number of spectral lines near the dominant
3 spectral line is 4 for a 1024-point spectrum.

1 8. The digital audio apparatus of claim 6, wherein:
2 said digital signal processor is further programmed to merge
3 nearby spectral lines that are within a predetermined frequency
4 range of each other prior to calculating the phase difference.

1 9. The digital audio apparatus of claim 7, wherein:
2 said digital signal processor is programmed to partition the
3 spectrum into a plurality of predetermined spectral bands
4 according to the Bark scale unrelated to the digital audio
5 signal.

1 10. The digital audio apparatus of claim 1, wherein:
2 said digital signal processor is programmed to partition the
3 spectrum into a plurality of contiguous spectral bands by

- 4 adjusting boundaries of spectral bands to maintain important
- 5 frequency groups within the same spectral band.

Evidence Appendix

None

Related Proceedings Appendix

None